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EXAMINER

HOFFBERG, ROBERT JOSEPH

ART UNIT	PAPER NUMBER
2835	

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Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/731,616

Applicant(s)

CHANG ET AL.

Examiner

Robert J. Hoffberg

Art Unit

2835

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 19 January 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-7,9-15,26,27,30 and 31 is/are rejected.
- 7) ☒ Claim(s) 8,28 and 29 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on 08 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

***Detailed Action***

***Specification***

1. The disclosure is objected to because of the following informalities: Page 12, lines 4-7 (Paras. 0027 and 0028), 710, 740 and 760 should be 810, 840 and 860 respectively.

Appropriate correction is required.

***Claim Rejections - 35 USC § 102***

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-4, 6-7, 10 and 13-15 are rejected under 35 U.S.C. 102(e) as being anticipated by Goodson et al. (US 2003/0062149).

With respect to Claim 1, Goodson et al. teaches a thermal management system, comprising: a heat generating component (Fig. 1, #50) that comprises a first area and a second area (Para. 0113, lines 8-9), wherein the first component area generates more heat than the second component area; and an evaporator (Fig. 1, #200) thermally coupled (Para. 0073, line 4) to the heat generation component to transfer the heat from the component to a working fluid, wherein the evaporator comprises a plurality of micro-channels (Fig. 3A, #220-1 and #220-2) to provide fluid paths (Para. 0073, line 10, flow

Art Unit: 2835

directions) from the component, wherein the micro-channels have a first channel width (Fig. 3A, #220-1 / #220-2 wide and Para. 0114, line 8) and a second channel width (Fig. 3A, #220-1 / #220-2 narrow and Para. 0114, line 8), wherein the micro-channels having a first channel width are disposed adjacent to the first component area (see Fig. 3B, Para. 0113, lines 8-9 and Para. 0114, lines 9-10) and the micro-channels having a second channel width are disposed adjacent to the second component area (see Fig. 3B, Para. 0113, lines 8-9 and Para. 0114, lines 9-10), wherein the first channel width is different (Para. 0125, lines 6-10) from the second channel width.

With respect to Claim 2, Goodson et al. further teaches a heat exchanger (Fig. 1, #400) coupled to the evaporator to remove heat from the working fluid; and a pump (Fig. 1, #300) coupled to the heat exchanger to transfer the working fluid to the evaporator.

With respect to Claim 3, Goodson et al. further teaches a thermal interface material (Para. 0073, lines 4-5) coupled to the component and the evaporator, wherein the thermal interface material reduces a thermal interface resistance between the component and the evaporator.

With respect to Claim 4, Goodson et al. further teaches wherein the working fluid comprises water (Para. 0186, line 1), super critical carbon dioxide, Freon, ammonia, methanol, acetone, ethanol, or heptane.

With respect to Claim 6, Goodson et al. further teaches wherein the first channel width (Fig. 3A, #220-1 / #220-2 wide and Para. 0114, line 8) is greater than the second channel width (Fig. 3A, #220-1 / #220-2 narrow and Para. 0114, line 8).

With respect to Claim 7, Goodson et al. further teaches wherein the working fluid is thermally coupled to the second component area (Fig. 3A, #50 right side) before being thermally coupled to the first component area (Fig. 3A, #50 left side).

With respect to Claim 10, Goodson et al. further teaches wherein indentations (Fig. 49, pits) provide nucleation sites (Para. 0251, line 2, Para. 0269, lines 2-3) in the plurality of micro-channels.

With respect to Claim 13, Goodson et al. teaches a thermal management system, comprising: means for providing heat transfer (Para. 0073, line 10, flow directions) in micro-channels (Fig. 3A, #220-1 and #220-2) of an evaporator (Fig. 1, #200) that is thermally coupled (Para. 0073, lines 4-5) to component (Fig. 1, #50) having a first temperature area and a second temperature area (Para 0113, lines 8-9); and means for increasing nucleation site density (Para. 0251, line 2, Para. 0269, lines 2-3) in the micro-channels.

With respect to Claim 14, Goodson et al. further teaches a means for transferring (Fig. 1, #300 and Fig. 3A, #220-1 and #220-2) a working fluid (Para. 0186, line 1) from the first temperature area to the second temperature area.

With respect to Claim 15, Goodson et al. further teaches a means for gradually warming (Fig. 3A, #250, Fig. 1, #500 and Para. 0122, line 2) a working fluid (Para. 0186, line 1).

#### ***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Goodson et al. (US 2003/0062149) as applied to claim 1 above, and further in view of Palmer (US 6,008,988).

With respect to Claim 5, Goodson et al. further teaches wherein the component is a central processing unit (Para. 0261, line 4). Goodson et al. fails to teach a processor and a cache. Palmer teaches wherein the component is a central processing unit (Fig. 1, #10), wherein the first component area is a processor (Fig. 1, #18) and the second component area is a cache (Fig. 1, #20). It would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify the thermal management system of Goodson et al. with that of Palmer for the purpose of combining several electronic devices into a multi-chip module.

6. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Goodson et al. (US 2003/0062149) as applied to claim 1 above, and further in view of Randlett et al. (US 6,067,712).

With respect to Claim 9, Goodson et al. teaches the thermal management system of claim 1, above. Goodson et al. fails to teach apertures providing nucleation sites. Randlett et al. teaches wherein apertures (Fig. 3, #38) provide nucleation sites (Col. 1, lines 46-47) in the plurality of micro-channels (Fig. 3, #18). It would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify

the thermal management system of Goodson et al. with that of Randlett et al. for the purpose of providing small opening for vapor bubbles to escape.

7. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Goodson et al. (US 2003/0062149) as applied to claim 1 above, and further in view of Janowski et al. (US 4,129,181).

With respect to Claim 11 and 12, Goodson et al. teaches the thermal management system of claim 1, above. Goodson et al. fails to teach sintered copper powder layer. Janowski teaches wherein a sintered copper powder layer (Col. 2, line 29) provide nucleation sites (Col. 2, line 26). It would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify the thermal management system of Goodson et al. with that of Janowski et al. for the purpose of providing nucleation sites at any place in the plurality of micro-channels including the horizontal and vertical surfaces where the formation of bubbles is desired to cool an electronic device.

8. Claims 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Goodson et al. (US 2003/0062149) as applied to claim 1 above, in view of Wang (US 6,118,656).

With respect to Claim 26, Goodson et al. teaches a method, comprising: transferring heat (Para. 0073, line 10, flow directions) from a heat generating component (Fig. 1, #50) to an evaporator (Fig. 1, #200), wherein the heat generating component has a first temperature area that is not equal to second temperature area (Para 0113, lines 8-9), wherein heat is transferred from the first temperature area

through a first plurality of flow channels (Fig. 4, #220A-1, #220A-2), wherein heat is transferred from the second temperature area through a second plurality of flow channels (Fig. 4, #220A-10, #220A-11), and generating vapors (Para. 0269, line 1) through a plurality of nucleation sites (Fig. 49, pits). While Goodson teaches varying the channel width, it fails to teach a first plurality of channels have different widths than a second plurality of channels. Wang teaches a first plurality of channels (Fig. 4, #d<sub>2</sub>) is wider than the second plurality of channels (Fig. 4, #d<sub>1</sub>). It would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify the thermal management system of Goodson et al. with that of Wang for the purpose of providing a greater amount of cooling to the greater heat dissipating electronic devices.

With respect to Claim 27, Goodson et al. teaches warming up a working fluid (Para. 0186, line 1) over the second temperature area (Fig. 3A, #50 right side) before the working fluid is thermally coupled (Fig. 3A, #220-1) to the first temperature area (Fig. 3A, #50 left side).

9. Claims 30 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Goodson et al. (US 2003/0062149) as applied to claim 1 above, in view of Wang (US 6,118,656) and further in view of Palmer (US 6,008,988).

With respect to Claim 30 and 31, Goodson et al. teaches a silicon die, comprising: a first plurality of channels positioned over a first component area to provide a flow path for the heat generated by the first component area; and a second plurality of channels positioned over a second component area to provide a flow path for the heat generated by the second component area. Goodson et al. fails to teach a processor



Art Unit: 2835

core and a cache. Also, while Goodson teaches varying the channel width, it fails to teach a first plurality of channels have different widths than a second plurality of channels. Wang teaches a first plurality of channels (Fig. 4, #d<sub>2</sub>) is greater than the widths than a second plurality of channels (Fig. 4, #d<sub>1</sub>). Palmer teaches a processor core (Fig. 1, #18) and a cache (Fig. 1, #20) coupled to the processor core. It would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify the thermal management system of Goodson et al. with that of Wang further in view of Palmer for the purpose of providing a greater amount of cooling to the greater heat dissipating electronic devices.

***Allowable Subject Matter***

1. Claims 8, 28-29 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: Claims 8 and all claims dependent thereof are allowable over the art of record because the prior art does not teach or suggest that a thermal management system comprising of a "heat generating component", an "evaporator" with a "top" and "bottom" portions wherein "the working fluid is warmed in the top portion before reaching the bottom portion." Claims 28 and all claims dependent thereof are allowable over the art of record because the prior art does not teach or suggest that a method transferring heat from a component to an evaporator" and "warming up the working fluid in a top portion of the evaporator". The, aforementioned limitations in combination with all

Art Unit: 2835

remaining limitations of the respective claims are believed to render said claims 8, 28 and all claims dependent thereof patentable over art of record.

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Robert J. Hoffberg whose telephone number is (571) 272-2761. The examiner can normally be reached on 8:30 AM - 4:30 PM Mon - Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lynn D. Feild can be reached on (571) 272-2092. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

RJH *RJH*

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